11116 - Exploring the Early FUV History of Cool Stars: Transition Regions at 30 Myr

Cycle: 16, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) V372-VEL	ACS/SBC	1	17-Jan-2008 19:28:55.0	yes
02	(2) V371-VEL	ACS/SBC	1	17-Jan-2008 19:28:58.0	yes
03	(4) V379-VEL	ACS/SBC	1	17-Jan-2008 19:29:01.0	yes
04	(5) V552-CAR	ACS/SBC	1	17-Jan-2008 19:29:04.0	yes
06	(9) V561-CAR	ACS/SBC	1	17-Jan-2008 19:29:06.0	yes
07	(11) V376-VEL	ACS/SBC	1	17-Jan-2008 19:29:09.0	yes

6 Total Orbits Used

ABSTRACT

Stellar magnetic activity derives from the so-called "dynamo," a hydromagnetic interplay between overturning plasma motions and differential rotation in stars cool enough to support significant surface convection zones. The magnetic fields resulting from dynamo action are in turn are responsible for a wide range of high-energy emissions, including the spectacular outbursts called flares. Dynamo powered magnetic activity is not confined solely to stars, but also must occur, for example, in accretion disks of all descriptions, and in some planets. A great deal is known about magnetic activity in middle-aged G dwarfs like our Sun, thanks to its proximity. Less is known, however, about the much younger stars, newly emerged from the T-Tauri stage. Yet, it is during this phase that they reach the peak of their magnetic activity, and subsidiary influences, such as the impact of ionizing radiation and strong coronal winds on developing solar systems, also are maximum. One of the key missing ingredients in our current understanding are measurements of FUV emissions of such stars, to complement the extensive collections of coronal (1-10 MK) X-ray measurements, particularly from recent ROSAT, Chandra and XMM-Newton surveys. We propose to conduct sensitive ACS/SBC prism ultraviolet spectroscopy of selected fields in two young (30 Myr) Galactic clusters--IC 2391 and IC 2602--to inventory the key C IV emission index (~0.1 MK) over a much larger and more diverse sample of coeval objects than has been possible hitherto. A key question is whether the FUV emissions also suffer the "saturation" and "super-saturation" at short rotation periods seen in coronal X-rays, or whether they continue to rise in the fastest rotating stars. The saturation behavior of the different temperature regimes holds important clues to the organization of the surface active regions on these very young stars, and should allow us to distinguish among several competing models.

OBSERVING DESCRIPTION

There are no previous measurements of our targets in the FUV. The large FOV of GALEX puts too many UV bright OBA stars on the detector, making observations of these clusters impossible (S/N in any case would be much lower). Thus, only HST can make these observations.

We choose the SBC PR130L prism (spectra) and F140LP (pre-image) to limit geocoronal Ly alpha. To test the feasibility of our proposed observations, we have estimated fluxes using HST GHRS spectra of three nearby rapid rotators with saturated activity as proxies: EK Dra (G1V, P_{rot} ~ 3 d, D = 33.9 pc, R ~ 1.05 R_sun), LQ Hya (K2V, P_{rot} ~ 1.8 d, D = 18.3 pc, R 0.75 R_sun), and YZ CMi (M4Ve, P_{rot} ~ 2.8 d, D = 5.1 pc, R ~0.40 R_sun). These stars nicely bracket our targets in temperature and radius. The spectra are scaled to the distances of our clusters (IC 2391, 175 pc, redenning 0.008 mag; IC 2602, 160 pc, redenning 0.024 mag). Figure 2 shows the result for IC 2391, rebinned to the resolution of PR130L data, together with the scaled but un-rebinned spectrum of LQ Hya. The major UV lines in this, the highest efficiency section of the

PR130L, can be clearly distinguished from the nearby (pseudo)-continuum with little blending of the major lines (except with others of like type, e.g., C IV with C IV). Indeed, we find (remarkably) that we can recover the measured high resolution fluxes for Si IV, C IV, and He II from the PR130L data within ~5%. Target star fluxes are interpolated from these model spectra fluxes (Table 1) by scaling the stellar radius and distance (for IC 2602); SS stars are assumed to have a factor of 2.0 less flux (a bit less than the factor of ~2.5 mean drop in X-rays). For the ETCs we extend the GHRS spectra beyond 1660 A at constant flux (an underestimate) to account for additional continuum, and used average backgrounds. For the SBC direct image we use F140LP to exclude Ly alpha. We aim for S/N = 10 in C IV, and S/N = 5 in the direct image; this gives the exposure times and S/N for other lines given in table 2.

With overheads of 6 min per guide star acquisition and 1.7 per exposure, we can fit one preimage and at least 2 spectra with S/N in C IV S/N_CIV ~ 10 of each of our targets, allowing some variation discrimination. For four of the targets, we can fit 5 to 7 spectra iof higher quality (S/N_CIV ~ 14 - 20) into an orbit, permitting 2 sigma detection of 10% and 14% variations on short timescales, respectively, sufficient to detect moderate size flares.

Using the NOMAD photometric database through Vizier, we estimated the V and B-V magnitudes and/or spectral types for most of the unknown stars which turned up in the ACS BOT. The ETC shows none of the targets posing any problem for the detector. (In several cases the BOT did not have enough information on our targets, and labeled them O5 stars... with additional photometric data, they prove entirely safe.)

REAL TIME JUSTIFICATION

N/A

CALIBRATION JUSTIFICATION

N/A

ADDITIONAL COMMENTS

Note that the above description has been modified from the phase one version.

Note also that spectra of two stars are obtained in the observation of V372 Vel

(see Table 2, owever, V375 Vel will not be possible). The spectra V372 and V373 Vel (a wide binary) will overlap to some extent, but for most roll angles the positional offset (~4") will be sufficient to make at least partial separation possible. In the limited range where overlap is strong, the 4" offset will still displace the emission lines in the merged spectrum, permitting separate measurement against a common (low, M star) continuum.

V376 Vel has been added as a substitute for V557 Car, which had nearby B0 star being assertively blue.

Visit

Proposal 11116, Visit 01, implementation Fri Jan 18 00:29:12 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V372-VEL Alt Name1: GSC08569-00072	RA: 08 43 27.8000 (130.8658333d) Dec: -52 57 37.00 (-52.96028d) Equinox: J2000		V=14.21+/-0.3	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

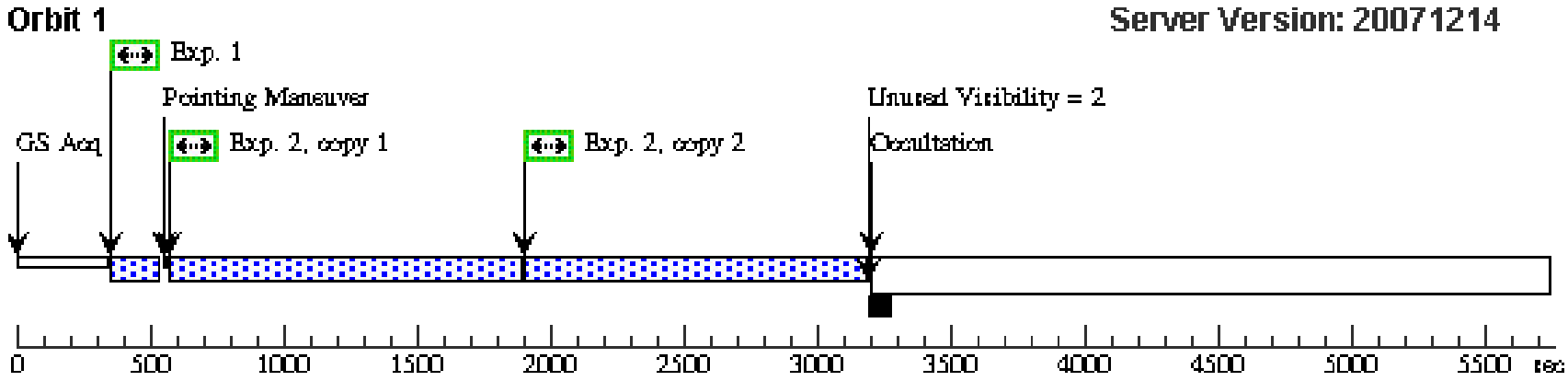
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	v372vel preimage	(1) V372-VEL	ACS/SBC, ACCUM, SBC	F140LP				118.0 Secs *[==>]*	*[1]*

Comments: pre-image

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
2	v372vel exposure	(1) V372-VEL	ACS/SBC, ACCUM, SBC	PR130L				1250.0 Secs X 2 *[==>(Copy 1)]* *[==>(Copy 2)]*	*[1]*

Comments: v372 vel exposure

Orbit Structure



Visit

Proposal 11116, Visit 02, implementation Fri Jan 18 00:29:13 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	V371-VEL Alt Name1: GSC08569-00696	RA: 08 42 18.4000 (130.5766667d) Dec: -53 01 57.00 (-53.03250d) Equinox: J2000		V=13.74+/-0.3	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

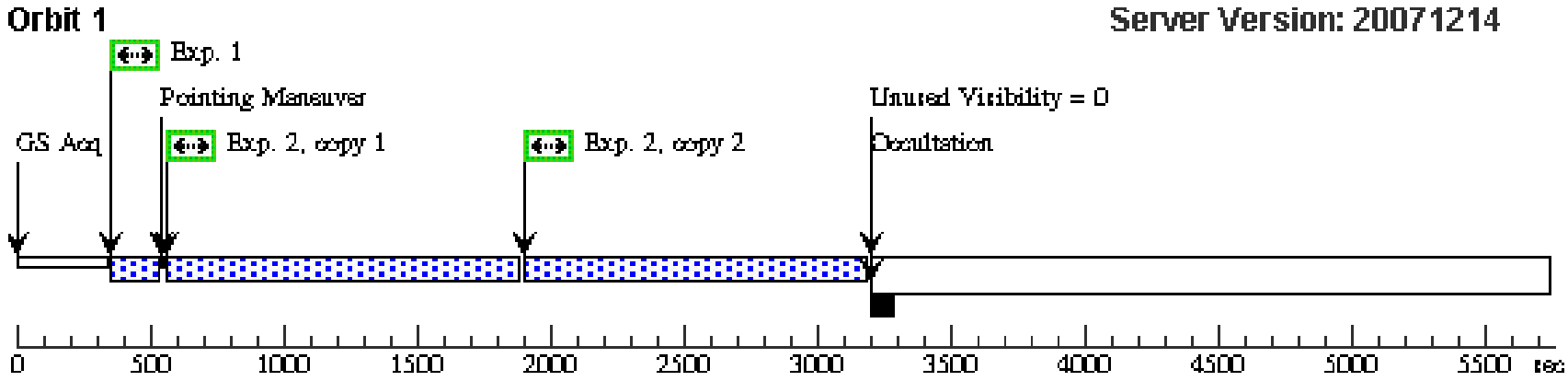
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	v371vel preimage	(2) V371-VEL	ACS/SBC, ACCUM, SBC	F140LP				110.0 Secs *[==>]*	*[1]*

Comments: v371vel preimage

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
2	v371 vel exposure	(2) V371-VEL	ACS/SBC, ACCUM, SBC	PR130L				1255.0 Secs X 2 *[==>(Copy 1)]* *[==>(Copy 2)]*	*[1]*

Comments: v371vel exposure

Orbit Structure



Visit

Proposal 11116, Visit 03, implementation Fri Jan 18 00:29:13 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	V379-VEL Alt Name1: GSC08569-01122	RA: 08 45 27.2000 (131.3633333d) Dec: -52 52 8.30 (-52.86897d) Equinox: J2000		V=12.76+/-0.2	Reference Frame: ICRS

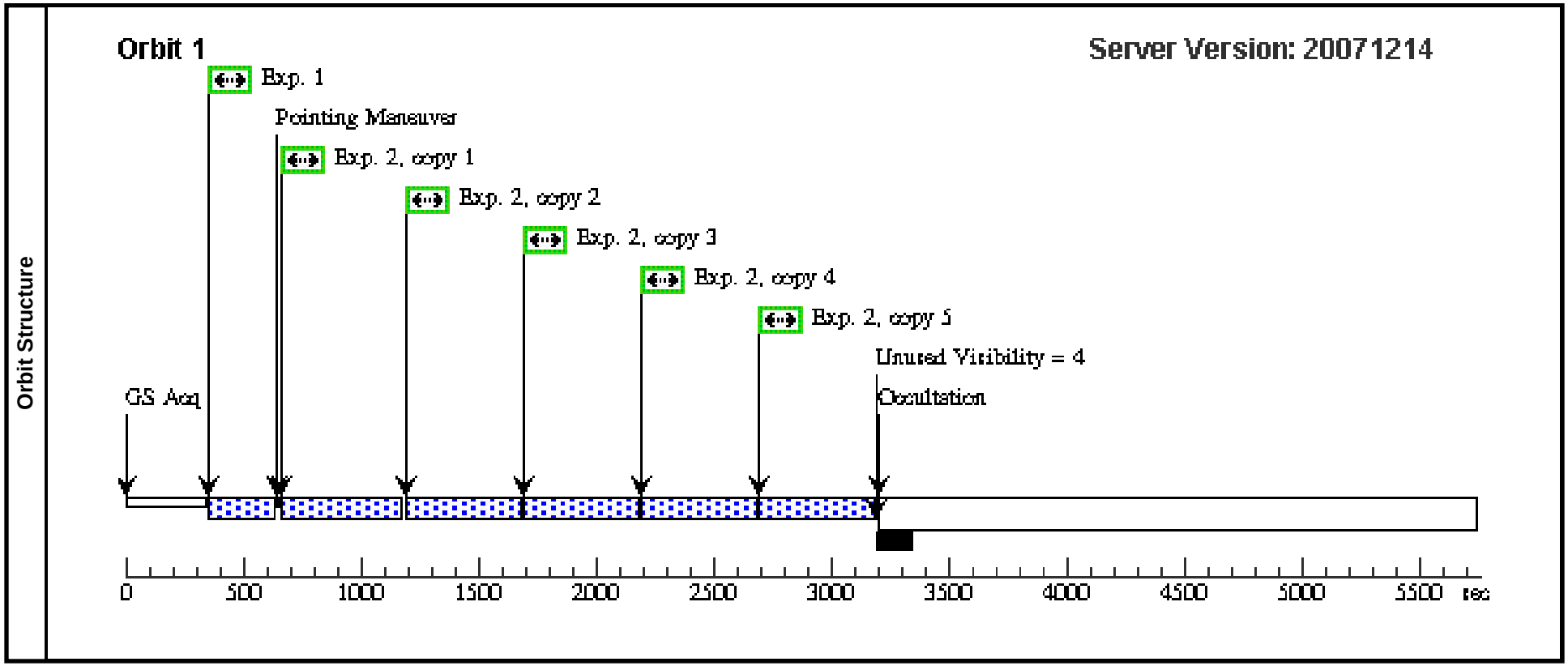
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Aimpoint slightly offset from target star to move overbright blue star out of FOV.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	v379vel preimage	(4) V379-VEL	ACS/SBC, ACCUM, SBC	F165LP				210.0 Secs	
								[==>]	***[1]***
2	v379vel exposure	(4) V379-VEL	ACS/SBC, ACCUM, SBC	PR130L				460.0 Secs X 5	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	
								[==>(Copy 3)]	
								[==>(Copy 4)]	
								[==>(Copy 5)]	

Comments: v379vel preimage

Comments: v379 exposure


Orbit Structure
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Server Version: 20071214
Exp. 1
Pointing Maneuver
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Exp. 2, copy 2
Exp. 2, copy 3
Exp. 2, copy 4
Exp. 2, copy 5
Unused Visibility = 4
GS Acq
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 11116, Visit 04, implementation Fri Jan 18 00:29:13 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

Special Requirements: (none)

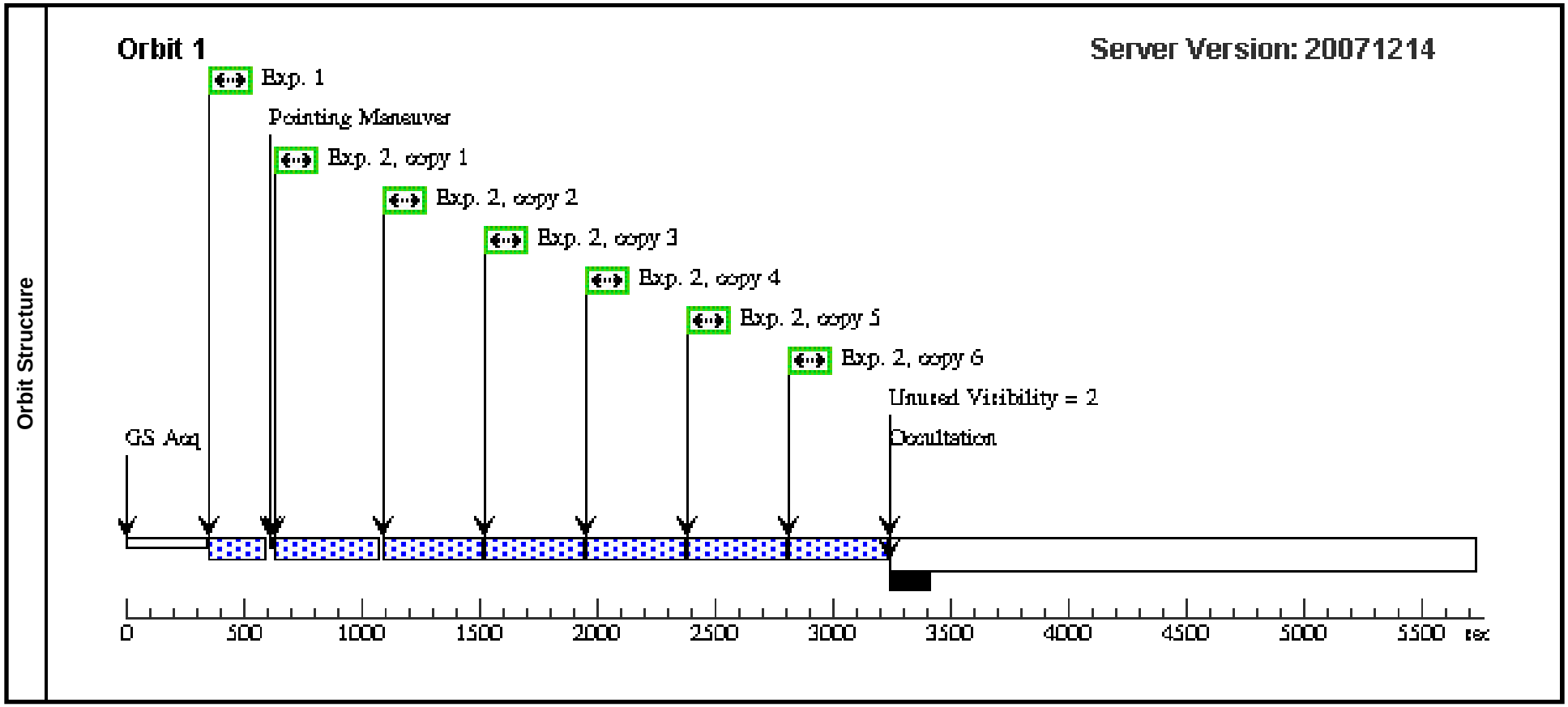
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	V552-CAR Alt Name1: GSC08965-00386	RA: 10 40 51.3000 (160.2137500d) Dec: -64 42 48.00 (-64.71333d) Equinox: J2000		V=12.19+/-0.2	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	v552car (rsp) preimage	(5) V552-CAR	ACS/SBC, ACCUM, SBC	F165LP				175.0 Secs	
								[==>]	***[1]***
Comments: v552car (rsp) preimage									
2	v552car (rsp) exposure	(5) V552-CAR	ACS/SBC, ACCUM, SBC	PR130L				390.0 Secs X 6	
								[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]*	***[1]***
Comments: v552car (rsp) exposure									


Orbit Structure
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Server Version: 20071214
Exp. 1
Pointing Maneuver
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Exp. 2, copy 2
Exp. 2, copy 3
Exp. 2, copy 4
Exp. 2, copy 5
Exp. 2, copy 6
Unused Visibility = 2
GS Acq
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 11116, Visit 06, implementation Fri Jan 18 00:29:14 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

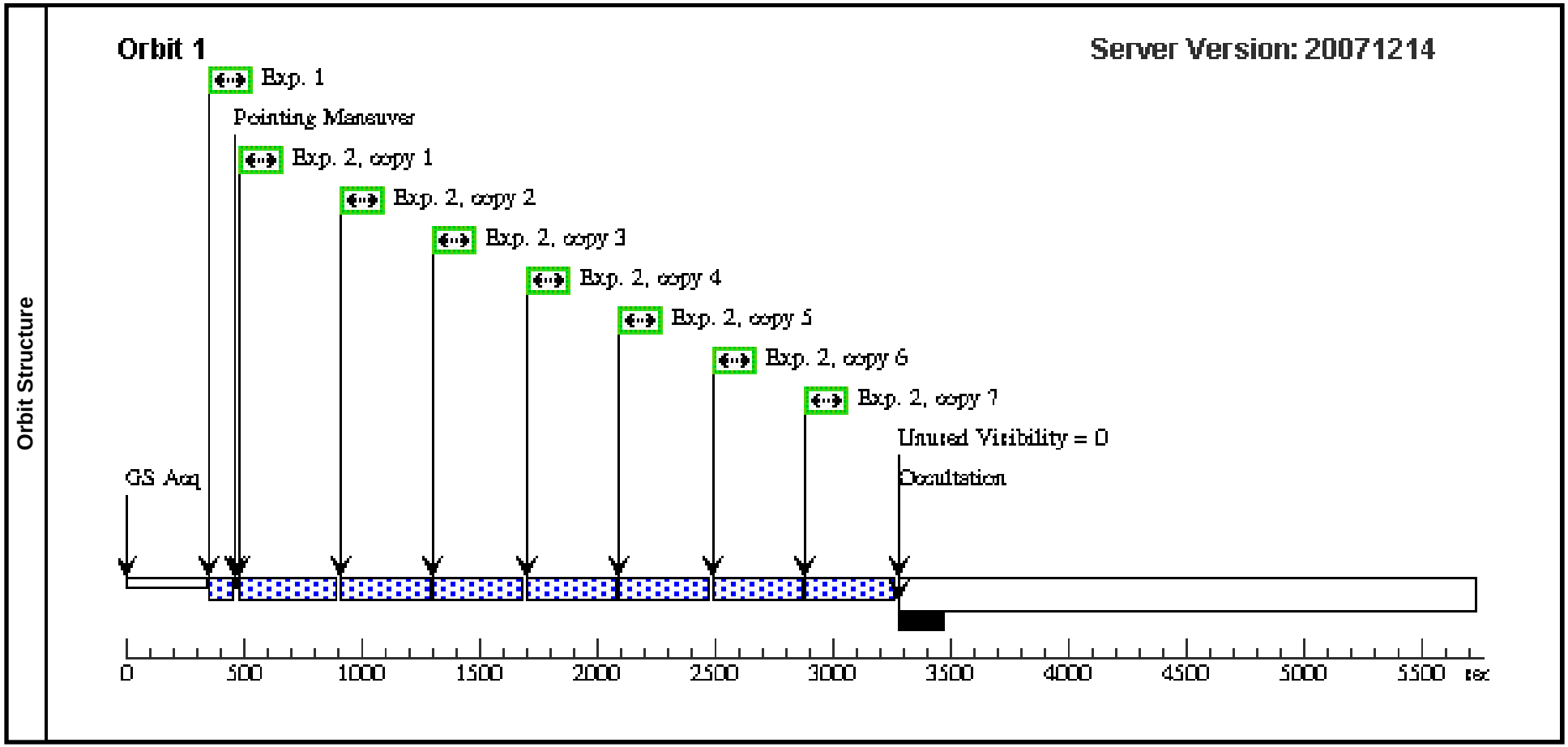
Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(9)	V561-CAR Alt Name1: GSC08965-00163	RA: 10 44 59.6000 (161.2483333d) Dec: -65 02 19.00 (-65.03861d) Equinox: J2000		V=10.85+/-0.1	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	v561car preimage	(9) V561-CAR	ACS/SBC, ACCUM, SBC	F165LP				30.0 Secs	
								[==>]	***[1]***
Comments: v561car preimage									
2	v561car exposures (fs)	(9) V561-CAR	ACS/SBC, ACCUM, SBC	PR130L				355.0 Secs X 7	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	
								[==>(Copy 3)]	
								[==>(Copy 4)]	
								[==>(Copy 5)]	
								[==>(Copy 6)]	
								[==>(Copy 7)]	
Comments: v561car exposures (flare study)									


Orbit Structure
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Server Version: 20071214
Exp. 1
Pointing Maneuver
Exp. 2, copy 1
Exp. 2, copy 2
Exp. 2, copy 3
Exp. 2, copy 4
Exp. 2, copy 5
Exp. 2, copy 6
Exp. 2, copy 7
Untried Visibility = 0
GS Acq
Occultation
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sec

Visit

Proposal 11116, Visit 07, implementation Fri Jan 18 00:29:14 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

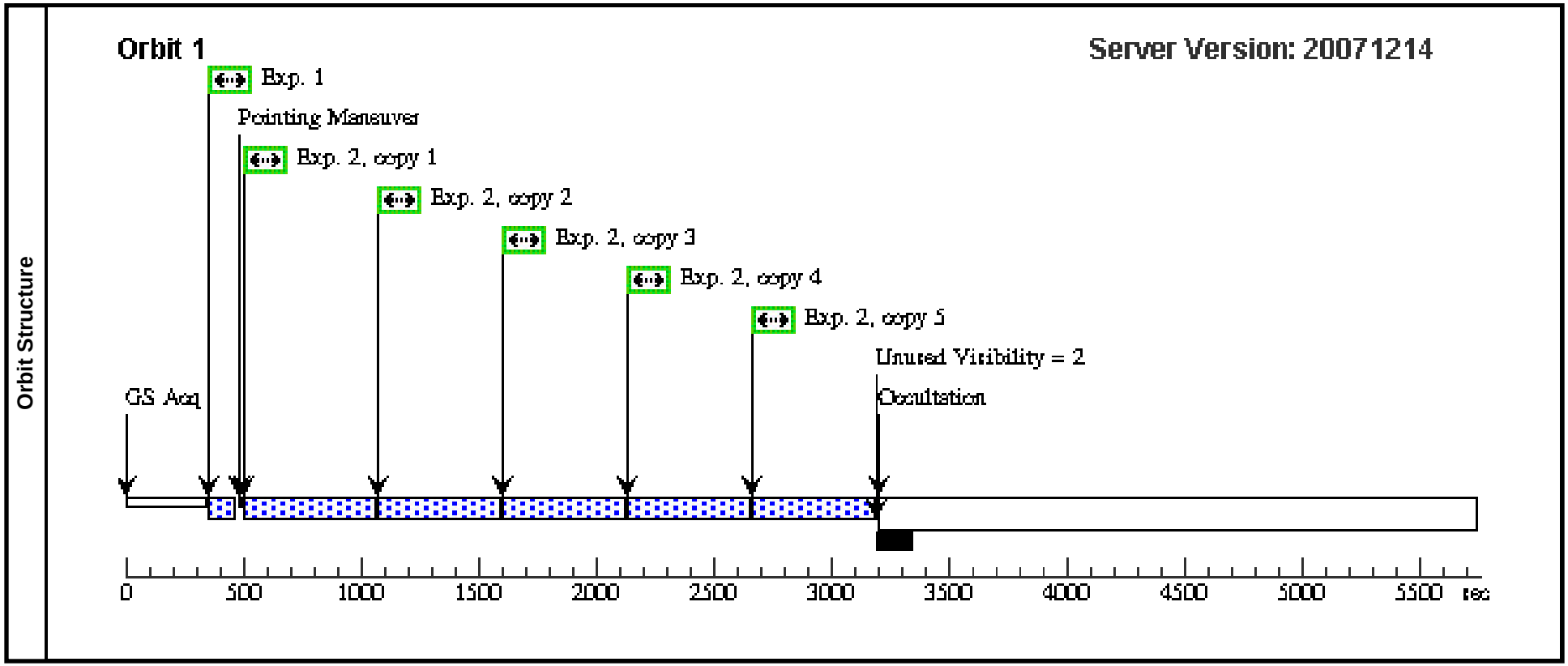
Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(11)	V376-VEL Alt Name1: GSC08569-00678	RA: 08 44 5.1863 (131.0216096d) Dec: -52 53 17.22 (-52.88812d) Equinox: J2000		V=10.85+/-0.2	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	v376vel preimage (temp)	(11) V376-VEL	ACS/SBC, ACCUM, SBC	F140LP				28.0 Secs	
								[==>48.0 Secs]	***[1]***
Comments: v376vel preimage (temp)									
2	v376vel exposure (temp)	(11) V376-VEL	ACS/SBC, ACCUM, SBC	PR130L				470.0 Secs X 5	
								[==>490.0 Secs (Copy 1)]	***[1]***
								[==>490.0 Secs (Copy 2)]	
								[==>490.0 Secs (Copy 3)]	
								[==>490.0 Secs (Copy 4)]	
								[==>490.0 Secs (Copy 5)]	
Comments: v376vel exposure (temp)									


Orbit Structure
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Exp. 1
Pointing Maneuver
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Exp. 2, copy 2
Exp. 2, copy 3
Exp. 2, copy 4
Exp. 2, copy 5
Unused Visibility = 2
GS Acq
Occultation
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